

ANNEX
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AND
BREAKTHROUGH STARSHOT FOUNDATION LLC UNDER SPACE ACT
UMBRELLA AGREEMENT
NO. 26616, DATED SEPTEMBER 13, 2018 (ANNEX NUMBER 1).

ARTICLE 1. PURPOSE

This Annex shall be for the purpose of cooperating on the Breakthrough Pre-Phase A activities for Breakthrough's Enceladus Mission. The Pre-Phase A activities will include conceptual studies that result in a published list of Preliminary Project Requirements (PPR) and a Mission Concept Review (MCR) document with recommendations. Pre-Phase A activities will lead to and inform a Key Decision Point A (KDP-A) to determine progress to Phase A, for further formulation of the Enceladus Mission's concept and technology development. NASA's involvement in Pre-Phase A activities will include providing scientific and technical consulting to Breakthrough during the requirements definition, design, and development phases, design reviews, and for issue-specific purposes.

The Pre-Phase A conceptual studies seek to evaluate Breakthrough's Enceladus Mission with potential targets as pre-cursory missions at Earth, or other solar-system destinations. As such, these conceptual studies will advance NASA's knowledge about planning and implementing future NASA space science and exploration missions to similar/same destinations that enable life detection measurements via low-cost mission concepts. Breakthrough seeks to evaluate science instruments and payloads, spectrometers, life detection technologies, airborne earth science instruments and guide the design and development of low-cost probes.

The fundamental scientific value of the Breakthrough Enceladus Mission Pre-Phase A conceptual studies to the scientific community is the opportunity to obtain:

- a. Conceptual studies for a space flight system, life finding mission to Enceladus. This will include an understanding of how to implement NASA's 'Ladder of Life Detection' requirements for bio-signatures and habitability determination.
- b. A published list of Preliminary Project Requirements (PPR) and a Mission Concept Review (MCR) document with recommendations.

The Pre-Phase A conceptual studies will allow both NASA and Breakthrough to understand the costs, risks, technological challenges, required development timeline, and science return related to a potential flyby mission to Enceladus.

The study does not seek to compete with existing NASA or other space agency missions, but rather seek to address targeted areas of scientific interest that are mutually beneficial to public, private and non-profit scientific pursuits. Breakthrough seeks to access unique capabilities and expertise available only at NASA and its Centers.

The legal authority for this Annex, consistent with the Umbrella Agreement, is in accordance with the National Aeronautics and Space Act (51 U.S.C. § 20113(e)).

ARTICLE 2. RESPONSIBILITIES

A. NASA will use reasonable efforts to:

- a. Provide scientific and technical consulting to Breakthrough during the Pre-Phase A conceptual studies to include the PPR, MCR, and KDP milestones.
- b. Provide expertise in the fields of astrobiology, planetary, biological, and Earth sciences, as well as planetary protection.
- c. Advise in the development of Phase A plans for a life signature mission to Enceladus.
- d. Provide scientific and technical consulting to Breakthrough during the Pre-Phase A requirements definition, design and development phases, design reviews, and for issue-specific purposes.

B. Breakthrough will use reasonable efforts to:

- a. Implement, manage, and fund the Pre-Phase A conceptual studies for a space flight systems project to Enceladus.
- b. Provide to NASA results of formal reviews, including the PPR and MCR.
- c. Notify NASA of mission milestone development reviews (PPR, MCR, KDP) and invite NASA to send representatives, subject to Breakthrough approval, to attend and observe such reviews.
- d. Provide NASA with Draft Phase A mission concepts and apprise them of the KDP-A outcome.
- e. Provide NASA with access to Breakthrough astrobiology, planetary, biological, and Earth science experts and research via advisors and committee members.
- f. Provide NASA with a request for planetary protection categorization prior to MCR. The mission project manager or principal investigator submits a written request for categorization of the mission to the Planetary Protection Officer. Correspondence regarding categorization is accompanied by a mission description that identifies the target object and any other Solar System bodies that could be encountered under the proposed spacecraft trajectory, as well as an overview of the proposed operations and end-of-mission scenario. The mission's request should include justification for a mission categorization following requirements in NID 8020.109A.

ARTICLE 3. SCHEDULE AND MILESTONES

The Parties agree to collaborate through a series of technical interactions with the goal of assisting Breakthrough with its execution of its Enceladus Mission and its objectives. In

coordination with NASA, Breakthrough has the option to modify the target dates noted below to align with the actual mission schedule.

The planned major milestones for the activities for this Annex defined in the "Responsibilities" Article are as follows:

Milestone 1:	March 2019	Review requirements and scope of work
Milestone 2:	June 2019	Preliminary Project Requirements (PPR)
Milestone 3:	September 2019	Mission Concept Review (MCR)
Milestone 4:	December 2019	Key Decision Point A (KDP-A)

A. Milestone 1: Review requirements and scope of work

- a. Target Date: March 2019
- b. Action:
 - i. Commencement meeting with all stakeholders
 - ii. Review mission, science, and organizational systems
 - iii. Identify committee and sub-committee membership
 - iv. Draft requirements, scope of work, schedule and budget
 - v. Record actionable items and circulate to committee
 - vi. Establish metrics for evaluation and expectations
- c. Success criteria:
 - i. Commencement meeting held with representation from stakeholders, including NASA and Breakthrough
 - ii. Program at commencement meeting included review of potential mission, current science objectives, and organizational structure for Pre-Phase A activities
 - iii. Formed committee and sub-committee which includes identified members or appropriate alternatives
 - iv. Preliminary requirements, scope of work, schedule, organizational chart drafts circulated to committee and sub-committee members
 - v. Demonstrated budgetary commitment by providing documentation to committee and sub-committee
 - vi. All Actions enumerated under Milestone 1 completed

B. Milestone 2: Preliminary Project Requirements (PPR)

- a. Target Date: June 2019
- b. Action:
 - i. Perform preliminary evaluations of possible mission concepts
 - ii. Identify key stakeholders for each phase of the life cycle
 - iii. Identify and perform trade-offs, risks and analyses of alternatives (AoA)
 - iv. Develop life cycle rough order of magnitude (ROM) cost, schedule, and risk estimates

- v. Establish technology/instrumentation assessment and maturation strategies
 - vi. Initiate discussion on planetary protection categorization
- c. Success criteria:
- i. Completed Preliminary Project Requirements (PPR) document
 - ii. Completed ranking of proposed mission concepts
 - iii. Completed list of Principal Investigators and Program Managers
 - iv. Demonstrated budgetary commitment by providing documentation to committee and sub-committee
 - v. Draft framework for planetary protection categorization request letter
 - vi. All Actions enumerated under Milestone 2 completed

C. Milestone 3: Mission Concept Review (MCR)

- a. Target Date: September 2019
- b. Action:
 - i. Principal Investigator presentation of the respective mission concept(s)
 - ii. Written request for planetary protection categorization is provided to NASA's Planetary Protection Officer
 - iii. Identify preliminary mission descope options.
 - iv. Develop preliminary assessment performed by the team of the top technical, cost, schedule, and safety risks and identification of associated risk management and mitigation strategies and options.
 - v. Determine initial technology readiness
 - vi. Present preliminary engineering development assessment and technical plans to achieve what needs to be accomplished in the next phase.
- c. Success criteria:
 - i. MCR affirms the mission requirements
 - ii. A complete written request for planetary protection categorization submitted to NASA's Planetary Protection Officer including a mission description that identifies the target object and any other Solar System bodies that could be encountered under the proposed spacecraft trajectory, an overview of the proposed operations and end-of-mission scenario, and a justification for a mission categorization following NID 8020.109A
 - iii. MCR Report with recommendations circulated to committee and sub-committee members
 - iv. Demonstrated budgetary commitment by providing documentation to committee and sub-committee
 - v. All Actions enumerated under Milestone 3 completed

D. Milestone 4: Key Decision Point A (KDP)

- a. Target Date: December 2019

- b. Action:
 - i. Principal Investigator presentation to sponsor(s)
 - ii. Committee chair review and recommendations
 - iii. Executive Director of Breakthrough Initiatives presents recommendations
 - iv. Preliminary decision is made
 - v. KDP-A decisional meeting is held
 - vi. Draft Phase A mission concept
- c. Success criteria:
 - i. Sponsor, executive director, chair of committee in agreement to proceed to Phase A of mission concept
 - ii. NASA recommends proceeding to Phase A
 - iii. Demonstrate budgetary commitment
 - iv. All Actions enumerated under Milestone 4 completed
- d. Key Decision Point - A: NASA and Breakthrough provide recommendation on whether project should proceed to Phase A

ARTICLE 4. FINANCIAL OBLIGATIONS

There will be no transfer of funds between the Parties under this Agreement and each Party will fund its own participation. All activities under or pursuant to this Agreement are subject to the availability of funds, and no provision of this Agreement shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act, (31 U.S.C. § 1341).

ARTICLE 5. INTELLECTUAL PROPERTY RIGHTS - DATA RIGHTS

- A. Data produced under this Annex which is subject to paragraph C. of the Intellectual Property Rights - Data Rights Article of the Umbrella Agreement will be protected for the period of five years.
- B. Under paragraph H. of the Intellectual Property Rights - Data Rights Article of the Umbrella Agreement, Disclosing Party provides the following Data to Receiving Party. The lists below may not be comprehensive, are subject to change, and do not supersede any restrictive notice on the Data provided.
 - 1. Background Data:
The Disclosing Party's Background Data, if any, will be identified in a separate technical document.
 - 2. Third Party Proprietary Data:
The Disclosing Party's Third Party Proprietary Data, if any, will be identified in a separate technical document.

3. Controlled Government Data:

The Disclosing Party's Controlled Government Data, if any, will be identified in a separate technical document.

4. The following software and related Data will be provided to Partner under a separate Software Usage Agreement:

None

ARTICLE 6. TERM OF ANNEX

This Annex becomes effective upon the date of the last signature below ("Effective Date") and shall remain in effect until the completion of all obligations of both Parties hereto, or five years from the Effective Date, whichever comes first, unless such term exceeds the duration of the Umbrella Agreement. The term of this Annex shall not exceed the term of the Umbrella Agreement. The Annex automatically expires upon the expiration of the Umbrella Agreement.

ARTICLE 7. RIGHT TO TERMINATE

Either Party may unilaterally terminate this Annex by providing thirty (30) calendar days written notice to the other Party.

ARTICLE 8. POINTS OF CONTACT

The following personnel are designated as the Points of Contact between the Parties in the performance of this Annex.

Management Points of Contact

NASA National Aeronautics and Space Administration

David Schurr

Deputy Director, Planetary Science Division

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Breakthrough Starshot Foundation LLC

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Program Director

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Moffett Field, CA 04035-0001

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ARTICLE 9. MODIFICATIONS

Any modification to this Annex shall be executed, in writing, and signed by an authorized representative of NASA and the Partner. Modification of an Annex does not modify the terms of the Umbrella Agreement.

ARTICLE 10. SIGNATORY AUTHORITY

The signatories to this Annex covenant and warrant that they have authority to execute this Annex. By signing below, the undersigned agrees to the above terms and conditions.

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

BREAKTHROUGH STARSHOT
FOUNDATION LLC

BY: 

Dr. Thomas Zurbuchen
Associate Administrator, Science
Mission Directorate

BY: 

Dr. S. Pete Worden
Chairman, Breakthrough Prize
Foundation, sole member of
Breakthrough Starshot Foundation LLC

DATE: 9/13/18

DATE: 13 Sep 2018